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SHORTER ARTICLES AND DISCUSSION

THE MIGRATION OF FISHES

UNDER the head of "The Migrations of Fish,"[1] Professor Alexander Meek has given a voluminous account of what is known of the movements and the distribution of the various families of fishes. The work is illustrated with drawings and photographs of many species, showing not only their forms and their movements, but often the stages of development and the structure of fins and scales. Especially valuable is a series of maps showing the geographical distribution of interesting groups. The word migration is taken in its largest sense, including not merely movements of individuals or of masses, but the larger problems of distribution, extending often over geological periods.

It is plain that distribution is intimately related to migration and migration to currents.

As the problems of fish conservation depend directly on the facts of migration and distribution, especial attention is given to the development and movements of food fishes and naturally to those of the North Atlantic.

After a general discussion of the continental and oceanic changes which have taken place since Eocene times, these having a direct bearing on modern conditions of fish-distribution, Professor Meek takes up the various groups of fishes, beginning with the lowest, treating of the habits, movements and distribution of each group in turn.

The excellent account of the lampreys and hag-fishes shows a certain omission. While the lampreys fasten themselves to other river fishes, sturgeons, catfishes and the like, rasping great holes with their teeth, the hag-fishes attack the throats of large sea-fishes, entering the muscular system and almost destroying it before the fish concerned finally dies. Around Monterey Bay, various flounders and rock-fishes (*Sebastichthys*) are thus attacked and drift about as living hulks while the hag-fish (*Polistotrema*) devours their muscular tissues.

The interesting parallelism in habits and distribution of the sturgeon and the lamprey is noted by Professor Meek and in both cases the facts now observed are of long standing. Both had apparently "refuge-regions" during glacial times. We do not, however, see the reason for the suggestion that the green sturgeon of California (now almost extinct) "may have been derived from the Atlantic during the post-glacial disturbance."

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[1] "The Migrations of Fish," by Alexander Meek, M.Sc., professor of zoology, Armstrong College in the University of Durham, and director of the Dove Marine Laboratory, Cullercoats. Edward Arnold, London, Longmans, Green & Co., New York. Price $4.50.

The migrations and breeding habits of the herring are treated with special fullness, proportionate to the economic value of the species. For in the north, as Björnson informs us, wherever a herring school touches the coast a town springs up, like driftwood on the beach.

In the account of the trout, very good as a whole, we may note that the genus *Salmo* is represented by different forms, originally derived from the Pacific coast, in the Great Basin of Utah, and also in the headwaters of the Colorado, Rio Grande, Arkansas and Platte, as well as the Columbia and Missouri. It is probable that the freshwater *irideus* (Rainbow trout) and the sea-run *gairdneri* (steelhead) are not really different, but both are quite separate from the cutthroat trout (*Salmo clarki,* wrongly identified at first by American authors with the Kamchatkan *Salmo mykiss*) from the Tahoe trout (*Salmo henshawi*) and from the several local forms which have sprung from these or which have preceded their advent. The last seems to be the case with the silver trout of Lake Tahoe (*Salmo regalis*). The suggestion of Professor Meek that the European salmon (*Salmo salar*) of the Miocene was divided into a North Atlantic and a Mediterranean form is interesting. The latter developed as a "trout" dividing into sea trout (*Salmo trutta*) and burn (or brook) trout (*Salmo fario*). But these two are as yet not really differentiated, corresponding in a way to the rainbows and steelheads of the Pacific coast. Professor Meek says:

> There is thus good reason for believing that the sea trout and the common trout may be the same, the one retaining the migratory habit and the other confining itself to fresh water.

Our own experience with the species lends probability to this view.

That "the salmon preceded the trouts" in time is also probable, but the western species of trout must have been derived from the trout of Europe and Asia.

The Pacific salmon must be older and more primitive than the Atlantic salmon, for the six species differ from one another, more than any trout or even the Atlantic salmon itself differs from any other black-spotted trout whatever.

Professor Meek hardly does justice to the spawning habits of the red or blueback salmon. It runs up rivers to varying distances—from one mile to 1,500 miles (Lake Labarge on the Yukon). But it never enters a stream which does not flow from a lake and it spawns always in the small streams at the head of the lake.

At Boca de Quadra in Alaska, the small stream is barely a mile long. It comes from a clear lake, perhaps five miles long. Into this stream and lake the salmon crowd by the thousands. The Yukon is not a good red salmon stream, because the nearest tributary lake, Labarge, is about 1,500 miles from the sea. Yet red salmon enter the river and reach the lake. In streams without lakes as the Skagway, red salmon are never seen. The King salmon (*Oncorhynchus tschawytscha*) also runs for great distances, but it is absolutely indifferent to the presence of lakes. It is probable that the red salmon spend their first winter in the lake and some never leave it, remain landlocked and dwarf until spawning time (usually four years).

One of the most difficult of problems is to understand the instinct of the red salmon. Every individual of this and of each of the other species of Pacific salmon (*Oncorhynchus*) dies after spawning. How does the spawning fish, stupid in most regards, know when it enters a river that there is a lake before it? How does it come to avoid all lakeless tributaries as it goes up, finally reaching the lake's head and the brooks that feed it? And why do the other salmon species totally lack this instinct? There are other problems, yet unsettled, regarding the supposed homing instincts of salmon. The majority (but not all) seem to return to spawn to the parent stream which they left as fingerlings. Why not all? And why any?

The recognition of the age of salmon and trout by the adjustment of the rings on the scales, as recently worked out by Dr. C. H. Gilbert and others, received full attention from Professor Meek. The scales of the salmon are marked by concentric rings of growth, and these are more widely separated in the summer, the feeding time of the salmon when the individual grows most rapidly.

Professor Meek devotes much space to the singular breeding habits of the eel, which spawns in the sea, entering rivers to feed. But many individuals, in our Mississippi Valley never descend to the sea. A very large eel, once taken by the present reviewer, above the Cumberland Falls in Kentucky, 2,000 miles from the sea, must either have never spawned or cast its spawn into the river.

The larvæ of eels as well as of some other soft-rayed species are quite pellucid, without pigment cells and with "a roomy space between the skin and the muscles, distended by a watery fluid." Many of these larvæ, in their transformation to the condition of young fishes become much reduced in size, though increasing in weight, by the obliteration of these interspaces.

Professor Meek's studies pass through the whole long series of fish-families. For want of space, we may not follow them further in these pages. We must give the work, as a whole, very high praise as carefully, intelligently and scientifically done, and as constituting a reference book of great value. The author has well covered the range of the periodicals which treat of the distribution and habits of fishes. He seems, however, to have overlooked the most extensive recent work of a similar range, "Jordan's Guide to the Study of Fishes," published in New York in 1905.

David Starr Jordan

NEW LIGHT ON BLENDING AND MENDELIAN INHERITANCE

Under the above heading, Dr. Castle reviews a paper by Yuzo Hoshino on the inheritance of the flowering time in peas and rice.

Since reading this review, Prof. Hoshino kindly sent us his paper, and we have ourselves examined it with care to see whether indeed it necessitates Dr. Castle's rather sweeping conclusions, namely, that certain genes are themselves modified by crossbreeding, one of the conclusions of Hoshino himself, and that selection within a pure line, within a genotypically pure population is effective.

It is well known that Dr. Castle counts among the few last geneticians, who still believe that the genes themselves are modifiable by selection. Hitherto in nearly all his writings on the subject Dr. Castle claimed, that unit characters vary, and may be modified by selection, a statement which can not very well be opposed, given the loose way in which the obsolete term unit character is usually applied. But it was clear, that Dr. Castle really believed the genes themselves to be capable of variability in potency, quality and value, and we think it of the utmost importance that in the review under discussion he has stated the